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# THE ALGA-FLORA OF YORKSHIRE:

## A COMPLETE ACCOUNT OF THE KNOWN FRESHWATER ALGÆ OF THE COUNTY.

BY

**W. WEST, F.L.S.,**

President of the Yorkshire Naturalists' Union;

AND

**G. S. WEST, B.A., A.R.C.S.,**

Hutchinson Research Student, and formerly Scholar of St. John's College, Cambridge; Professor of Natural History at the Royal Agricultural College, Cirencester.

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THE

# ALGA-FLORA OF YORKSHIRE.

Yorkshire, being much the largest county in England, is in consequence of its diversified topographical characters fairly rich in freshwater algæ, although as compared with either Westmorland or Cumberland it lacks many of the more uncommon species. This is due to the different character of the geological formations, which consist of carboniferous, oolitic, and other limestones, shales, grits, and alluvial deposits. The mountainous portion of the county is not so productive as such a region would be were its strata composed of the older Palæozoic rocks, or if it possessed some rocks of an eruptive, igneous origin. In the extreme north-west a trap-dyke does occur in a very limited area, and this appears to have considerably augmented the richness of that district. In addition to the Silurian rocks near Sedbergh, there are a few other such small inliers of this formation, but they do not appear to have much influence on the general alga-flora. The mountainous region, known as the north-western fells, is a district of lofty hills, thirty-six of which attain an altitude of 2,000 feet or more, the highest point being Mickle Fell (2,596 feet). There are many sub-alpine algæ found in this extensive district, and many rare ones, but only a few of the upland bogs are productive of the rarer species, most of which are obtained from small springs high up on the mountains and from the dripping rocks of the ghylls and glens. In this district the three largest natural sheets of water are Malham Tarn (altitude 1,250 feet) Semer Water, and Birkdale Tarn, the first-mentioned being much the most productive.

It is impossible to find a permanently moist situation in which algæ are absent. They are found on damp earth, rocks, walls, palings, shaded tree-trunks, in spouts, rain-tubs, etc.; they are met with again in all kinds of running water, from the tumbling cataract and rapid torrent to the slow, majestic river; but it is in perfectly quiet waters that they are most prolific, whether it be in the tiny moor-pool or the expansive lake. Some even find shelter in symbiotic relationship with other plants; for instance, a species of *Anabæna* lives with the aquatic Lycopod *Azolla*, and another lives with the Hepatic *Blasia*, to say nothing of those associated with fungi to form the compound dual organism known as a lichen, or those symbiotically connected with such animals as *Hydra viridis* and certain species of *Amœba*.

Many of the larger freshwater algæ are noticeable as green, slimy masses floating on the surface of or attached to the sides of ponds, ditches, rivers, etc. Small tufts of these are best collected in tubes or small bottles. Constantly dripping rocks yield quite characteristic species, and even shady, moist rocks have an alga-flora of their own. On vertical, moist rocks (especially limestone) it is not uncommon to find coriaceous patches, or gelatinous masses, of a red, brown, green, bluish-green or blackish colour, and an examination of such masses is always interesting.

There are a vast number of beautiful algæ which are very minute, and the places in which they abound are not usually obvious to the casual observer. They generally occur about the stems and leaves of submerged plants, such as *Utricularia minor*, *Myriophyllum*, *Nymphæa*, *Nuphar*, *Potamogeton*, *Scirpus fluitans*, *Isoëtes*, etc. Many of the Muscineæ, such as *Sphagnum contortum*, *S. plumosum*, *Amblystegium scorpioides*, *A. falcatum*, *A. exannulatum*, *A. glaucum*, *Fontinalis antipyretica*, *Jungermannia inflata*, *Nardia emarginata*, etc., are often richly clothed with small species. The best way to collect from plants of this kind is to remove them (or portions of them) from the water with

as little mud as possible, and allow the water to drain away for about a minute or more; they should then be gently squeezed over a wide-mouthed bottle, allowing the issuing water to collect in the bottle. For several reasons the bottles should not be filled quite full. We have known about a thimbleful of such a slimy squeezing to yield more than a hundred (or even three hundred) species and many thousands of individuals. This is exceptional, however, and as a contrast a similar squeezing from another locality might yield hardly more than one or two species, and these of the commonest.

If possible, algæ should always be examined when freshly gathered, as many of them are more easily determined in the living state. It may be as well to note, however, that a large number of the Desmidieæ, especially those with characteristic surface markings, can only be determined with precision from dead, empty cells, or semi-cells.

Algæ of all kinds are best preserved by adding to the water in which they are living an equal volume of a weak solution (about 2%) of potassium acetate (to which has been added a minute quantity of cupric acetate). They may also be preserved by adding a few crystals of carbolic acid to the fluid containing them (about six or eight grains of crystallized carbolic acid to each ounce of liquid), but the outlines of the cells have not the clearness shown by those preserved in potassium acetate. Most algæ are much better for examination when preserved in a fluid medium than when dried. On drying they usually collapse, and on being soaked out they very often do not reattain their original form. Most of the Myxophyceæ, however, can be preserved very well by drying, and at the same time they retain their bright colours, this being a distinct advantage over those preserved in fluid.

Most of the mountain tarns are but poor collecting places, the best being Oughtershaw Tarn (Mid-West Yorks.) and Hunter's Hole, Craydale Moor (North-West Yorks.), both of which are in the midst of deep peat at an elevation of about

2,000 feet. The best results were obtained, however, from small, permanent, peaty pools containing *Sphagnum plumosum* and *S. contortum*, and from some of those rocks over which the water incessantly trickles. It might not be amiss here to emphasize the importance of these gatherings from vertical wet rocks, as many of the rarest Desmids and the best Myxophyceæ are to be obtained from the gelatinous material of various colours coating the surfaces of rocks constantly kept moist by a thin film of water. The moorlands stretching in a westerly direction from Ilkley and Keighley are not so rich as the more northern districts, and present a sameness and specific uniformity which is markedly absent from the latter.

The most productive grounds for Desmids are those of the Central Plain, the commons at Pilmoor, Strensall and Riccall being parts of the primæval boggy country, and both in their topography and alga-flora are very similar to the commons of south-west Surrey. Unfortunately, Strensall Common has now been drained for military purposes, and nearly all its former treasures have gone. Pilmoor, near Thirsk, is probably the richest locality in Yorkshire for Desmids, above 130 species having been found there, among which were many very rare ones. Cocket Moss, near Giggleswick, is also a very rich locality for this family of Conjugatæ, and a boggy place about two miles south of Clapham, on the way to Bowland Knotts, was also productive of many uncommon Desmids. The best gatherings from both Pilmoor and Cocket Moss were obtained from *Utricularia minor*. The bogs and springs of Upper Teesdale were found to be exceptionally rich in many of the uncommon species.

The largest natural sheet of water in the county is Hornsea Mere, but it is comparatively poor in algæ, being similar in that respect to the rest of the low-lying land in the East Riding.

The list of algæ published in Lees' 'Flora of West Yorkshire' (1888) was very hurriedly put together; it was followed by several other papers and notes referring to the algæ of Yorkshire,

the most important of which are:—Additions to the Algæ of West Yorkshire, Nat., March and April, 1889; Algæ from Birkdale Tarn, Nat., Aug., 1889; Freshwater Algæ of North Yorkshire, J. of Bot., vol. 27, 1889; Additions to the Freshwater Algæ of West Yorkshire, Nat., Aug., 1891; Notes on the Freshwater Algæ of the East Riding of Yorkshire, Nat., July, 1893. There are also three papers of importance by W. B. Turner; these were published prior to the 'Flora of West Yorkshire,' and are:—The Algæ of Strensall Common, Nat., Dec., 1883; Notes on Freshwater Algæ with descriptions of new species, Nat., Feb., 1886; Notes on Algæ collected at Gormire and Thirkleby, Nat., Sept., 1887. In addition to the above there is a paper which was published by George Norman in 1860, entitled 'List of Diatomaceæ occurring in the neighbourhood of Hull,' Trans. Micr. Soc., vol. 8. Since the appearance of the above papers a large amount of material has been collected and examined from many parts of the county, with the result that the number of species has been greatly increased, and a large number of additional localities have been found for species already recorded.

The authorities in brackets after some of the localities refer to the persons who have recorded the species from those localities, and if the mark ! follows the locality we have also seen a specimen from that locality. In all other cases the records are entirely our own.

We here express our indebtedness to all who have at any time collected material for us, our thanks being especially due to Mr. Ll. J. Cocks for some most excellent gatherings from Pilmoor, as well as various material from Harrogate, Knaresborough, near Jervaulx Abbey and other places. Mr. J. Beanland collected for us in certain parts of the East Riding, Mr. I. H. Burkill in the Scarborough district, Mr. W. Denison Roebuck in Upper Swaledale, from Birkdale Tarn, etc., the Rev. W. Fowler about Liversedge, etc., and Mr. J. J. Marshall about Market Weighton. Mr. M. H. Stiles sent us some slides of

diatoms from near Doncaster, and followed up this action by very kindly placing at our disposal a full and valuable list of the diatoms of that district. In his list were enumerated about 125 species and many varieties, about a dozen of each of which were additions to the flora. Of those localities vouched for by Mr. Stiles 'Askern district' includes Askern, Wrancar Drain, and Thorpe brickpond; 'Cusworth district' includes Cusworth, Scawthorp and Bentley; and 'Hatfield district' includes Hatfield West Moor, Hatfield brickponds, and Sandall brickpond; 'Doncaster Town Water' is from Firsby, Thrybergh, and Sheffield.

Though we have made hundreds of journeys in quest of algæ, we have not personally visited every district in Yorkshire, yet we trust that the result of our efforts will form a substantial basis-list, serving as a useful guide to future workers both in the matter of the classification of these plants and in the species they may expect to find. The classification adopted is the one we think the most accurate and reliable, and great pains have been taken to ensure that the nomenclature is as accurate as possible. In a paper of this kind it is essential that some synonyms should be given, as they are so useful to other workers, especially when, as in many cases, they are the names under which the plants have been at one time recorded for the county; moreover, they are often the names (erroneous ones) found in English text books. For these reasons as many synonyms have been introduced as were considered to be necessary for the use of those who are not well versed in the more recent phycological literature.

There will no doubt appear to be a dearth of localities for many Œdogoniaceæ and Zygnemaceæ, which are in reality widely distributed. This is largely due to the fact that only those species have been recorded that were in a satisfactory condition for accurate identification, that is to say, those which possessed ripe spores (oospores or zygospores).

All measurements are given in mm. or thousandths of a mm. ($\mu$). 1 $\mu$=·001 mm.

Of the complete alga-flora at least 55 species have not previously been recorded for the British Isles; special mention is made of this under the species. Mention is also made of those varieties and forms which are similarly new records to Britain.

The following call for particular notice:—

*Hormiscia zonata* (Webb & Mohr.) Aresch. var. *bicolor* (Eng. Bot.) Nob.

*Debarya calospora* (Palla) Nob.

*Penium curtum* Bréb. var. *obtusum* West & G. S. West.

*Closterium parvulum* Näg. var. *angustum* West & G. S. West.

*Closterium sigmoideum* Lagerh. & Nordst. forma *major*.

*Closterium acutum* (Lyngb.) Ralfs var. *linea* (Perty) Nob.

*Xanthidium variabile* West & G. S. West.

*Cosmarium subprotumidum* Nordst. var. *Gregorii* (Roy & Biss.) Nob.

*Cosmarium Pokornyanum* (Grun.) Nob.

*Cosmarium cymatopleurum* Nordst. var. *Archerii* (Roy & Biss.) Nob.

*Cosmarium tetragonum* (Näg.) Arch. var. *Davidsonii* (Roy and Biss.) Nob.

*Cosmarium Willei* Nob. var. *ordinatum* West & G. S. West.

*Cosmarium pericymatium* Nordst. var. *eboracense* West & G. S. West.

*Staurastrum gladiosum* Turn. var. *delicatulum* West & G. S. West.

*Staurastrum pileolatum* Bréb. var. *Brasiliense* (Börg.) Lütkem.

*Rhaphidium setigerum* (Schröder) Nob.

## Class **FLORIDEÆ.**

### Family *BATRACHOSPERMEÆ.*

#### Genus BATRACHOSPERMUM Roth., 1797.

1. **Batrachospermum moniliforme** Roth.

Mid W.—Stream near Towton. Washburn Valley. Blubberhouses (E. Howgate). Malham (H. F. Parsons). Penyghent. Leeds district (W. B. Turner). Meanwood (J. Abbott). Baildon. Sherburn Town Drain (F. A. Lees). Malham Tarn (C. B. Crawshaw and C. P. Hobkirk). Markington! (Rev. J. S. Tute).

S.W.—Battye-ford near Mirfield (H. F. Parsons). Upper Bradfield (Rev. A. Gatty). Swinefleet Warping-Drain (H. F. Parsons). Skelmanthorpe. Allerton.

Var. **stagnale** Ag.

Mid W.—Malham Cove (C. B. Crawshaw and C. P. Hobkirk).

2. **Batrachospermum vagum** (Roth.) Ag.

Mid W.—Kirkstall (W. B. Turner). Near Giggleswick.

S.W.—Bingley.

N.E.—Strensall (var.; W. B. Turner). Castle Howard. Scarborough Mere.

Var. **keratophytum** (Bory) Sir.

Mid W.—In stream, Horton-in-Ribblesdale.

3. **Batrachospermum atrum** (Dillw.), Harv.

Mid W.—Barkston (H. F. Parsons). Meanwood! (J. Stubbins).

#### Genus CHANTRANSIA Fries, 1825.

4. **Chantransia chalybea** (Lyngb.) Fries.

S.W.—Near Halifax. Hainworth (T. Hebden). Marley, near Bingley.

Mid W.—Baildon.

5. **Chantransia violacea** Kütz.

S.W.—On dripping stones amongst *Rhynchostegium rusciforme*, Horton Park, Bradford.

Mid W.—Eldwick. Ingleborough.

6. **Chantransia pygmæa** Kütz.

Mid W.—Bolton Woods. Ingleton. Douk Ghyll on the western slope, and Heseltine Ghyll on the eastern slope of Penyghent. Whernside.

7. **Chantransia Hermannii** (Roth.), Kütz.

S.W.—North Dean.

Mid W.—Shipley Glen.

Family *HILDENBRANDTIACEÆ.*

Genus HILDENBRANDTIA Nardo, 1845.

8. **Hildenbrandtia rivularis** (Liebm.), J. Ag.

[Syn. *H. rosea* Kutz. var. *fluviatilis* Kutz.].

S.W.—Forming dark-red patches on rocks and stones in streams and dripping-places, not frequent. Anston Crags (Rev. Hild. Friend).

Mid W.—In rill near Rawdon! (H. T. Soppitt). Shipley Glen. Gordale.

Family *LEMANEACEÆ.*

Genus LEMANEA Bory, 1808.

9. **Lemanea fluviatilis** Ag.

On rocks, stones, and wood in streams and torrents; also in mill-sluices. Generally where the force of the water is greatest.

Mid W.—General, but scarce. Shipley Glen. Kildwick. In the river Crimple, Spofforth! (F. A. Lees). River Wharfe, Boston Spa and Wetherby! (F. A. Lees). Leathley. Near Harrogate! (T. Hick; Ll. J. Cocks). Ripon (W. Brunton). Near Giggleswick. Ingleborough.

S.W.—Upper Bradfield, near Sheffield (Rev. R. A. Gatty).

N.W.—Cautley Spout.

10. **Lemanea torulosa** (Roth.), Ag.

Mid W.—On vertical face of rocks of waterfall, Malham (iii. 1894).

Class **FUCOIDEÆ.**

Family *HYDRURACEÆ.*

Genus HYDRURUS Ag., 1824.

11. **Hydrurus penicillatus** Ag.

S.W.—Newsholme Dean, near Keighley (T. Hebden).

Mid W.—Esholt.

## Class CHLOROPHYCEÆ.

### Order CONFERVOIDEÆ HETEROGAMÆ.

#### Family *COLEOCHÆTACEÆ.*

Genus COLEOCHÆTE Bréb., 1844.

12. **Coleochæte scutata** Bréb., 1844.

S.W.—Doncaster. Frequent about Bradford (on *Elodea*, etc.). Shipley.

Mid W.—Adel Bog (J. Abbott).

N.E.—Strensall (W. B. Turner). Malton. Scarborough Mere.

S.E.—Skipwith Common. Market Weighton.

13. **Coleochæte orbicularis** Pringsh.

S.W.—Frizinghall Dam, on *Elodea canadensis*, reaching a diameter of 3 mm.; (abundant, iii. 1895).

N.E.—Pilmoor, near Thirsk.

14. **Coleochæte soluta** Pringsh.

N.E.—Pilmoor, near Thirsk.

Species of this genus are, as a rule, epiphytic on aquatic phanerogams: they are no doubt generally distributed, but are very easily overlooked.

Genus APHANOCHÆTE Berth., 1878.

15. **Aphanochæte repens** Berth.

Mid W.—Baildon Moor, on *Cladophora crispata* and *Œdogonium macrandrum*. Markington! (Rev. J. S. Tute). Malham Tarn Bog.

N.E.—Malton. Saltburn.

16. **Aphanochæte pilosissima** Schmidle.

Mid W.—Staveley Dam, near Knaresborough.

N.W.—Lund's Fell, attached to *Mougeotia* sp. and to *Zygnema pectinatum*.

17. **Aphanochæte polytricha** Nordst.

N.W.—Mossdale Moor, Widdale Fell; a small form, diam. cell. 14 $\mu$. Previously unrecorded for the British Isles.

## Family *ŒDOGONIACEÆ.*

### Genus BULBOCHÆTE Ag., 1817.

18. **Bulbochæte intermedia** De Bary.

N.E.—Pilmoor, near Thirsk.

19. **Bulbochæte setigera** (Roth)., Ag.

S.W.—Cullingworth.

Mid W.—Adel Bog (J. Abbott). Yeadon Dam. Rombald's Moor.

N.E.—Strensall ! (W. B. Turner).

20. **Bulbochæte rectangularis** Wittr.

N.E.—Strensall ! (W. B. Turner).

### Genus ŒDOGONIUM Link., 1820.

21. **Œdogonium cryptoporum** Wittr. var. **vulgare** Wittr.

S.W.—Bradford district.

Mid W.—Markington ! (Rev. J. S. Tute).

22. **Œdogonium vernale** (Hass.), Wittr.

N.W.—Masham.

23. **Œdogonium nodulosum** Wittr.

S.E.—Skipwith Common.

Not recorded previously from the British Isles.

24. **Œdogonium Vaucherii** (Le Cl.), A. Br.

N.W.—Cronkley Fell.

25. **Œdogonium Itzigsohnii** De Bary.

Mid W.—Ingleborough. Cray Moss.

N.E.—Strensall Common.

26. **Œdogonium platygynum** Wittr.

N.E.—Pilmoor, near Thirsk.

S.E.—Riccall Common.

27. **Œdogonium Rothii** (Le Cl.), Pringsh.

S.W.—Near Bradford.

28. **Œdogonium undulatum** (Bréb.), A. Br.

N.E.—Strensall Common. Pilmoor, near Thirsk; in very fine fruit (vii. 1897).

29. **Œdogonium cyathigerum** Wittr.

S.W.—Rawcliffe Common. Only previously known in this country from Harefield, Middlesex.

30. **Œdogonium flavescens** (Hass.), Wittr.

S.W.—Bradford district.

31. **Œdogonium Braunii** Kütz.

Mid W.—Adel Bog (J. Abbott). Baildon.

32. **Œdogonium macrandrum** Wittr.

Mid W.—Baildon Moor.

33. **Œdogonium acrosporum** DeBary.

N.E.—Pilmoor, near Thirsk.

34. **Œdogonium ciliatum** (Hass.), Pringsh.

Mid W.—Bramhope (W. B. Turner).

35. **Œdogonium calcareum** Cleve.

N.W.—Cronkley Fell.

36. **Œdogonium Pringsheimii** Cram. var. **Nordstedtii** Wittr.

S.W.—Frizinghall, in ponds with *Œdogonium Boscii*.

This variety has not before been recorded from the British Isles.

37. **Œdogonium punctato-striatum** DeBary.

N.E.—Strensall Common. Pilmoor near Thirsk. In fine fruit, vii., 97.

38. **Œdogonium Boscii** (Le Cl.), Wittr.

S.W.—Frizinghall, in ponds.

N.E.—Pilmoor, near Thirsk.

39. **Œdogonium tumidulum** Kütz.

Mid W.—Bramhope and Adel (J. Abbott).

40. **Œdogonium rivulare** (Le Cl.), A. Br.

S.W.—Dewsbury district (C. B. Crawshaw and C. P. Hobkirk).

Mid W.—Baildon.

41. **Œdogonium giganteum** Kütz.

S.W.—Near Mirfield; this was recorded in Lees' 'Flora of West Yorkshire' as *Œdogonium Landsboroughii* (Hass.), Wittr. The

determination was kindly made for us by Karl E. Hirn, of Helsingfors, Finland. It has not previously been recorded from the British Isles.

42. **Œdogonium princeps** (Hass.), Wittr.

N.W.—Near Sedbergh.

43. **Œdogonium vesicatum** (Lyngb.), Wittr.

Mid W.—Bramhope (J. Abbott).

N.E.—Strensall (W. B. Turner).

44. **Œdogonium Ahlstrandii** Wittr.

N.E.—Pilmoor, near Thirsk.

This species has not previously been recorded from the British Isles.

45. **Œdogonium subsetaceum** Kütz.

N.W.—Near Sedbergh.

46. **Œdogonium delicatulum** Kütz.

S.W.—Askern.

N.E.—Strensall (W. B. Turner).

47. **Œdogonium tapeinosporum** Wittr.

N.E.—Pilmoor, near Thirsk.

Not previously recorded from the British Isles.

### Family *CYLINDROCAPSACEÆ.*

#### Genus CYLINDROCAPSA Reinsch, 1867.

48. **Cylindrocapsa geminella** Wolle var. **minor** Hansg.

N.E.—Carlton Bank.

Only known elsewhere in the British Isles from Cambridgeshire.

## Order CONFERVOIDEÆ ISOGAMÆ.

### Family *ULVACEÆ.*

#### Genus ENTEROMORPHA Link., 1820.

49. **Enteromorpha intestinalis** (L.), Link.

Generally distributed in ditches and drains throughout the county; also more rarely in ponds.

S.W.—Bradfield (Rev. R. A. Gatty). Goole (H. F. Parsons). In the Thorn River or Dyke, Rossington (F. A. Lees). In the

lakes at Horton Park, Bradford. In the canal and in several ponds, Frizinghall. Doncaster.

Mid W.—Sherburn (F. A. Lees). Garforth, near Leeds (W. B. Turner).

N.E.—Carlton Bank.

Genus PRASIOLA Ag., 1821.

50. **Prasiola crispa** (Lightf.), Ag.

S.W.—General. Huddersfield (C. P. Hobkirk). Copley (H. F. Parsons). Allerton. Cullingworth.

Mid W.—Wetherby (F. A. Lees). Leeds ! (J. Abbott). Rombald's Moor ! (H. F. Parsons). Markington ! (Rev. J. S. Tute). Shipley.

N.W.—Sedbergh.

N.E.—Scarborough.

Genus SCHIZOMERIS Kütz., 1843.

51. **Schizomeris Leibleinii** Kütz.

N.W.—On stones subject to the spray of a waterfall in Stone Gill, Dodd Fell (iv. 1898).

Not previously recorded for the British Isles.

Family *ULOTRICHACEÆ.*

Sub-Family Ulotricheæ.

Genus SCHIZOGONIUM Kütz., 1843.

52. **Schizogonium murale** Kütz.

On damp ground, old walls, old wood, etc.

S.W.—Bradford. Swill Hill.

Mid W.—Garforth (J. Abbott).

Genus HORMIDIUM Kütz., 1843.

53. **Hormidium murale** (Lyngb.), Kütz. [Syn. *Lyngbya muralis* Ag., 1824; *Ulothrix radicans* Kütz., 1849].

S.W.—Coley, near Shelf. Bradford. On shady rocks near Bingley.

Mid W.—Leeds. Roundhay (J. Abbott). Otley. Skipton. Gordale (C. B. Crawshaw and C. P. Hobkirk).

54. **Hormidium parietinum** (Vauch.), Kütz.

[Syn. *Ulothrix parietina* Kütz., 1849].

S.W.—Dewsbury (C. B. Crawshaw and C. P. Hobkirk). Halifax. Bradford.

Mid W.—Leeds. Skipton.

Genus HORMISCIA Fries, 1835; em. Aresch., 1866.

55. **Hormiscia subtilis** (Kütz.), De Toni.

[Syn. *Ulothrix subtilis* Kütz.].

S.W.—Ogden Clough.

Mid W.—Bowland Knotts. Wigton Moor.

N.W.—Dodd Fell, at 2,000 feet.

Var. **subtilissima** Rabenh., 1868.

[Syn. *Ulothrix subtilissima* Rabenh., 1863].

S.W.—Bradford (ix. 1896).

Mid W.—Baildon (iv. 1895), amongst mosses on dripping rocks. Cells $1\frac{1}{2}$—4 times longer than the diameter, with a very pale green, parietal chlorophyll-plate : thickness 4 $\mu$.

Var. **variabilis** (Kütz.), Kirchn.

[Syn. *Ulothrix variabilis* Kütz.].

S.W.—Holmfirth (C. P. Hobkirk). Crimsworth Dean. Ogden Clough. Horton. Heaton. Keighley. Cragg Vale, towards Blackstone Edge.

Mid W.—Shipley Glen. Hawksworth. Earl's Seat. Bride Cross, above Farnley Moor. Langcliffe. Simon's Fell. Linn Ghyll. Ribblehead. Malham.

N.W.—Cowgill Wold Moss, Widdale Fell. Bog near Widdale Beck. Cronkley Fell.

N.E.—Carlton Bank. Near Scarborough. Pilmoor, near Thirsk. Malton.

Var. **tenerrima** (Kütz.), Kirchn.

[Syn. *Ulothrix tenerrima* Kütz.].

S.W.—Ogden Clough. Swill Hill. Holmfirth (C. P. Hobkirk). Barnsley. Bradford. Heaton. Keighley Moor.

Mid W.—Baildon. Above Eldwick. Bride Cross, above Farnley Moor. Kilnsey. Kirkby Malham (C. B. Crawshaw and C. P. Hobkirk). Ribblehead.

N.W.—Mickle Fell. Hawes. Mossdale Moor, Widdale Fell.

56. **Hormiscia tenuis** (Kütz.) De Toni.
[Syn. *Ulothrix tenuis* Kütz.].

S.W.—Swill Hill. Frizinghall. Marley.

Mid W.—Eldwick. Ilkley.

N.W.—River Ure.

N.E.—Malton.

57. **Hormiscia rivularis** (Kütz.) De Toni. [Syn. *Hormidium rivulare* Kütz.; *Ulothrix rivularis* Kütz.].

S.W.—Marley, near Bingley.

58. **Hormiscia æqualis** (Kütz.) Rabenh. var. **catæniformis** (Kütz.) Rabenh.

S.W.—Near Mirfield. Bradford.

Mid W.—Malham (C. B. Crawshaw and C. P. Hobkirk). Horton-in-Ribblesdale.

N.W.—Lund's Fell.

59. **Hormiscia moniliformis** (Kütz.) Rabenh.

S.W.—Cullingworth. Holden Ghyll and Worth Valley, near Keighley.

Mid W.—Baildon. Cowside Beck, Arncliffe. Ingleborough. Linn Ghyll. Whernside.

N.W.—Mickle Fell. Great Shunnor Fell. Lund's Fell. Widdale Beck. Cautley Spout.

N.E.—Stokesley.

60. **Hormiscia zonata** (Web. et Mohr.) Aresch.

S.W.—Frizinghall. Keighley Moor.

Mid W.—Baildon. Eldwick. Gordale (C. B. Crawshaw and C. P. Hobkirk). Malham and Malham Tarn Bog. Penyghent.

N.W.—Mickle Fell. Great Shunnor Fell. Hawes. Cautley Spout and Sedbergh.

S.E.—Near Meaux Abbey.

Var. **bicolor** (Eng. Bot.) Nob. [Syn. *Conferva bicolor* Eng. Bot., 1790—1814; *Hormiscia speciosa* (Carm., 1833) Rabenh., 1868; *H. zonata* var. *valida* (Näg., 1849) Rabenh., 1868].

More or less abundant in mountain streams, more especially in the earlier months of the year.

S.W.—Crimsworth Dean. Holden Ghyll, near Keighley.

Mid W.—Leathley. Linn Ghyll. Crook Ghyll near Buckden.

N.W.—Near Sedbergh. Near the 'Moorcock Inn'. Cotterdale. Abundant in the River Ure (iii. 1889).

Genus RHAPHIDONEMA Lagerh., 1892.

61. **Rhaphidonema nivale** Lagerh.

Mid W.—Langcliffe, near Settle (viii., 1896).

Thickness of filaments, 2·5—3·5 $\mu$; total length of filaments, 94—123 $\mu$.

Not previously recorded for the British Isles.

Genus HORMOSPORA Bréb., 1840.

62. **Hormospora ordinata** West & G. S. West.

Mid W.—Cam Fell.

The small size of the cells, their remoteness and comparative shortness sufficiently differentiate this species. The cell-contents are bright green and very granulose.

63. **Hormospora dubia** Schmidle.

S.W.—In horse-trough, Allerton, near Bradford (vi., 1898).

This species has not previously been recorded for the British Isles.

Genus GLŒOTILA Kütz., 1843.

64. **Glœotila protogenita** Kütz.

N.E.—Pilmoor, near Thirsk.

Previously unrecorded for the British Isles.

Genus GEMINELLA Turp., 1828.

65. **Geminella interrupta** Turp., 1828; em. Lagerh., 1883.

N.E.—Pilmoor, near Thirsk.

Only known elsewhere in the British Isles from Glen Tilt, Perthshire.

SUB-FAMILY CHÆTOPHOREÆ.

GENUS HERPOSTEIRON Näg., 1849.

66. **Herposteiron repens** (A. Br.) Wittr. [Syn. *Aphanochæte repens* A. Br., 1851, non Berth., 1878].

S.W.—Frizinghall, on *Œdogonium* sp. and *Cladophora flavescens.* Bradford, in aquarium, on *Lemna trisulca* and *Elodea canadensis.*

MID W.—Hawksworth, on *Cladophora.*

N.E.—Pilmoor, near Thirsk. Terrington.

*Herposteiron* Näg. is distinguished from *Aphanochæte* Berth. by the structure of its bristles; they are articular and strongly remind one of the piliferous apices of the branches of *Chætophora.* Those of *Aphanochæte* are quite simple and possess a sheathing base, which is not septate. In both these genera the chlorophyll masses are parietal. These plants are usually found as epiphytes on larger algæ (*Cladophora*, *Œdogonium*, etc.) and on *Lemna*, *Elodea*, *Nitella*, etc.

GENUS NORDSTEDTIA Borzi, 1892.

67. **Nordstedtia globosa** (Nordst.) Borzi. [Syn. *Herposteiron globosa* Nordst.; *Aphanochæte globosa* Wolle].

MID W.—Cocket Moss, near Giggleswick.

N.E.—Strensall Common.

S.E.—Skipwith Common.

The cells of this plant are spherical and each bears on its dorsal surface a very long seta, which is quite simple. The chromatophores are central and more or less stellate, and the plants are enveloped in mucus.

GENUS CHÆTOSPHERIDIUM Klebahn, 1892.

68. **Chætospheridium minus** Hansg., 1893, [Syn. *Aphanochæte globosa* var. *minor* Hansg.; *Chætospheridium Pringsheimii* Klebahn, 1892].

N.E.—Pilmoor, near Thirsk.

The chromatophores are plate-like and parietal; the cells are not enveloped in mucus.

GENUS CHÆTOPHORA Schrank, 1789.

69. **Chætophora pisiformis** (Roth.) Ag., 1812.

S.W.—Rawcliffe. Askern. Frizinghall.

MID W.—Near Giggleswick. Boston Spa. Near Selby.

N.W.—Ure Head, Lund's Fell.

S.E.—Beverley.

70. **Chætophora tuberculosa** (Roth.) Ag.

S.W.—Keighley (T. Hebden).

MID W.—Baildon. Airton. Buckden. York! (T. Hick). Askham Bog.

N.E.—Strensall (W. B. Turner).

71. **Chætophora elegans** (Roth.) Ag.

S.W.—Dewsbury (C. B. Crawshaw and C. P. Hobkirk).

MID W.—Adel and Roundhay, near Leeds (W. B. Turner). Baildon. Selby (H. F. Parsons).

N.W.—Mickle Fell. Cotterdale.

N.E.—Saltburn. Strensall! (W. B. Turner). Terrington.

72. **Chætophora cornu-damæ** (Roth.) Ag.

[Syn. *Chætophora endivæfolia* Auct.].

S.W.—Saltaire. Bingley.

MID W.—Horton-in-Ribblesdale. Near Buckden.

N.E.—Strensall. Pilmoor, near Thirsk. Scarborough Mere! (G. E. Massee, 1881); very fine (viii. 1890).

GENUS DRAPARNAUDIA Bory, 1808.

73. **Draparnaudia glomerata** (Vauch.) Ag.

MID W.—Markington! (Rev. J. S. Tute). Roundhay, near Leeds (W. B. Turner). Eldwick. Ilkley. Ingleton. Bell Busk.

S.W.—Dewsbury (C. B. Crawshaw). Eccleshill, near Bradford! (W. Nuttall). Bingley. Holden Ghyll, near Keighley.

74. **Draparnaudia plumosa** (Vauch.) Ag.

S.W.—Upper Bradfield (Rev. R. A. Gatty). Clayton.

Mid W.—Adel Bog ! (J. Abbott). Wetherby (H. F. Parsons). Leathley. Near Norwood Hall, above Lindley Reservoir.

N.E.—Strensall (W. B. Turner).

S.E.—Beverley.

Var. **pulchella** (Kütz.) Rabenh.

Mid W.—In stream, Penyghent.

Genus STIGEOCLONIUM Kütz., 1843.

75. **Stigeoclonium protensum** (Dillw.) Kütz.

S.W.—Liversedge ! (Rev. W. Fowler). Well, Darton (C. B. Crawshaw and C. P. Hobkirk). Wibsey. Keighley.

Mid W.—Farnley (W. B. Turner). Burley ! (W. Nuttall). Ilkley.

N.E.—Pilmoor, near Thirsk.

76. **Stigeoclonium nanum** (Dillw.) Kütz.

S.W.—Near Dewsbury (C. B. Crawshaw and C. P. Hobkirk). Ogden Clough. Coley, near Shelf. Bradford. Heaton.

77. **Stigeoclonium fastigiatum** Kütz.

S.W.—Soothill, Dewsbury (C. B. Crawshaw and C. P. Hobkirk). Near Wakefield. On stones, in stream, Halifax.

Mid W.—Still waters of a spring, Moughton Fell.

78. **Stigeoclonium tenue** (Ag.) Rabenh.

S.W.—Liversedge ! (Rev. W. Fowler).

Mid W.—Horton-in-Ribblesdale. Ribblehead.

N.W.—Near 'Moorcock Inn.'

N.E.—Scarborough Mere.

79. **Stigeoclonium uniforme** (Ag.) Rabenh.

S.W.—On the surface of a pond, Frizinghall (iv., 95).

Stratum yellow-green, filaments of uniform diameter (7·5 $\mu$), forming intricate, contorted bundles; at places somewhat geniculate. Branches scarce, mostly unilateral, short, much attenuated and with piliferous apices. Cells of main filaments equal to, or twice longer than, the diameter; those of the branches as long as broad. Zoogonidia formed by the division of the cell-contents into four.

Previously unrecorded for the British Isles.

GENUS PROTODERMA Kütz., 1843.

80. **Protoderma viride** Kütz., 1843 [Syn. *Entocladia gracilis* Hansg., 1888; *Endoderma gracilis* De Toni, 1889; *Periplegmatium gracile* Hansg., 1890].

S.W.—Near Bradford, epiphytic on *Elodea canadensis*. Frizinghall, on *Coleochæte orbicularis*.

MID W.—Baildon, on *Callitriche stagnalis* and *Nitella flexilis*. Boston Spa, on *Callitriche*.

N.E.—Pilmoor, near Thirsk. Terrington. Malton.

A small epiphytic, subparenchymatous alga; diameter of cells 3·5—6 $\mu$.

Apparently widely distributed in England.

FAMILY *CONFERVACEÆ*.

GENUS CONFERVA L., 1737; em. Lagerh., 1888.

81. **Conferva bombycina** Ag.

S.W.—Norland Moor and Goole (H. F. Parsons). Liversedge! (Rev. W. Fowler). Bradford. Pontefract (H. F. Parsons). Heaton.

MID W.—Embsay. Adel Bog. Baildon. Eldwick. Boston Spa. Cocket Moss, near Giggleswick. Ingleborough. Horton-in-Ribblesdale. Penyghent. Whernside. Oughtershaw, and Oughtershaw Tarn. Beamsley Beacon.

N.W.—Mickle and Cronkley Fells. Great Shunnor Fell. Hunter's Hole, Craydale Moor (1900 ft.). Mossdale Moor, Widdale Fell. Lund's Fell.

N.E.—Pilmoor, near Thirsk. Malton. Stokesley. Near Scarborough.

S.E.—Waghen. Near Meaux Abbey. Newsholme. Market Weighton.

The most abundant species of the genus and widely distributed.

Forma **minor** Wille.

S.W.—Denholme. Oxenhope.

MID W.—Baildon. Eldwick. Bride Cross, above Farnley Moor. Otley. Penyghent. Near Oughtershaw Tarn. Whernside.

N.E.—Pilmoor, near Thirsk.

S.E.—Beverley. Routh. Near Meaux Abbey. Waghen. Riccall Common. Skipwith Common ! (Rev. W. Fowler).

82. **Conferva ? tenerrima** Kütz.

S.W.—Bradford.

Mid W.—Leeds and Adel (J. Abbott). Grassington. Ingleborough. Penyghent. Oughtershaw Tarn.

N.W.—Mickle Fell. Hunter's Hole, Craydale Moor (1900 ft.).

N.E.—Peat deposit, Filey. Pilmoor, near Thirsk.

83. **Conferva affinis** Kütz.

S.W.—Askern.

Mid W.—Cam Fell.

N.E.—Pilmoor, near Thirsk.

84. **Conferva raciborskii** Gutw.

S.W.—Abundant in a trough, Shipley. Cullingworth.

N.W.—Cautley Spout.

Thickness of filaments 25—31 $\mu$.

85. **Conferva undulata** West and G. S. West.

S.W.—Ogden Clough. Old Cote Moor.

Genus MICROSPORA Thur., 1851 ; em. Lagerh., 1888.

86. **Microspora floccosa** (Vauch.) Thur. [Syn. *Conferva floccosa* Ag.].

S.W.—Bradford. Nab Wood, near Bingley. Saltaire. Near Keighley.

Mid W.—Adel Bog. Chapel Allerton (J. Abbott). Ilkley. Kilnsey. Penyghent.

N.W.—Mickle and Cronkley Fells. Great Shunnor Fell. Sedbergh.

N.E.—Pilmoor, near Thirsk. Strensall ! (W. B. Turner).

S.E.—Waghen.

87. **Microspora vulgaris** Rabenh.

S.W.—Bradford.

Mid W.—Ilkley. Ribblehead.

N.W.—Cronkley Fell. Snaizeholme Fell.

N.E.—Strensall. Scarborough Mere.

S.E.—Market Weighton.

88. **Microspora fugacissima** (Roth.) Rabenh.

S.W.—Bradford. Dewsbury (C. B. Crawshaw and C. P. Hobkirk).

Mid W.—Rombald's Moor. Grassington. Leeds. Ingleborough. Bowland Knotts. Adel Bog.

N.W.—Sedbergh. Mickle Fell.

N.E.—Strensall ! (W. B. Turner). Pilmoor, near Thirsk.

89. **Microspora pachyderma** (Wille) Lagerh.

Mid W.—Cocket Moss, near Giggleswick. Oughtershaw.

S.E.—Skipwith Common ! (Rev. W. Fowler).

90. **Microspora wittrockii** (Wille) Lagerh.

Mid W.—Stream near Gigglewick and Giggleswick Common.

N.W.—Head of Great Sleddale, 1750 ft. (viii. 1895). Cautley Spout.

N.E.—Pilmoor, near Thirsk.

91. **Microspora abbreviata** (Rabenh.) Lagerh. [Syn. *Conferva abbreviata* Rabenh., 1863; *C. funkii* Kütz., 1849.]

S.W.— Frizinghall.

N.W.—Bog, near Widdale Beck.

92. **Microspora fontinalis** (Berk.) De Toni.
[Syn. *Conferva fontinalis* Berk.].

S.W.—Heaton.

Mid W.—Blubberhouses (W. B. Turner). Adel Bog. Rombald's Moor.

N.W.—Mickle and Cronkley Fells. Cotterdale.

Genus OPHIOCYTIUM Näg., 1849.

93. **Ophiocytium arbuscula** (A. Br.) Rabenh.
[Syn. *Sciadium arbuscula* A. Br.].

Mid W.—Harrogate (J. Abbott).

N.E.—Terrington (vi., 98).

94. **Ophiocytium cochleare** (Eich.) A. Br.

Mid W.—Baildon Moor. Eldwick. Wigton Moor. Malham Tarn Bog. Penyghent. Aldfield ! (Rev. J. S. Tute), recorded as *O. majus* in 'Naturalist,' May, 1890, p. 153.

N.W.—Birkdale Tarn Moss.

N.E.—Terrington. Saltburn. Gormire (W. B. Turner). Pilmoor, near Thirsk.

S.E.—Near Meaux Abbey. Waghen. Routh. Newsholme. Riccal and Skipwith Commons.

Var. **bicuspidatum** Borge.

N.E.—Pilmoor, near Thirsk.

The forms seen agreed with those mentioned by Lemmerman (Forschungsberichte Biol. Stat. Plön, 1896, p. 163, c. fig.) as *f. longispina*. This variety has not previously been recorded for the British Isles.

95. **Ophiocytium majus** Näg.

Mid W.—Bramhope (J. Abbott). Eldwick. Staveley Dam, near Knaresborough.

N.E.—Pilmoor, near Thirsk.

96. **Ophiocytium parvulum** (Perty) A. Br.

[Syn. *Brochidium parvulum* Perty].

Mid W.—Cocket Moss, near Giggleswick. Malham Tarn Bog. Boston Spa.

## Family *CHROOLEPIDACEÆ*.

### Genus TRENTEPOHLIA Mart., 1817.

97. **Trentepohlia aurea** (L.) Mart. [Syn. *Byssus aureus* L., 1753; *Chroolepus aureus* Kütz., 1843].

S.W.—Fairly general away from the towns; most abundant in the limestone districts. Sheffield (S. Anston; A. Carr). Roche Abbey (F. A. Lees). Bingley. Snaith and Conisborough (H. F. Parsons).

Mid W.—Ilkley. Bolton Woods. Knaresborough and Sherburn (F. A. Lees). Deighton. Wetherby. Tadcaster. Arncliffe. Giggleswick. Ingleton. Moughton Fell. Upper Ribblesdale (F. A. Lees).

N.W.—Cronkley Fell. Lund's Fell. Hawes. Dent Dale.

N.E.—Staithes! (C. Crossland).

GENUS LEPTOSIRA Borzi, 1883.

98. **Leptosira mediciana** Borzi.

N.E.—Pilmoor, near Thirsk, among *Utricularia minor*. Small forms, thickness of cells 7·5—11·5 $\mu$. .

A characteristic and very rare plant, only previously recorded from Italy. This reminds one of a young stage of *Microthamnion kützingianum*, but is less elongate, the cells are somewhat swollen and barrel-shaped, the cell walls are stronger and the cell-contents are of a well-marked yellow-green colour.

GENUS MICROTHAMNION (Näg., 1849) Kirchn., 1878.

99. **Microthamnion strictissimum** Rabenh., 1863.
[Syn. *M. vexator* Cooke, 1882].

S.W.—Greetland, near Halifax. Oxenhope. Allerton. Bingley. Keighley Moor.

MID W.—Above Eldwick. Blubberhouses ! (W. B. Turner). Bog, two miles south of Clapham.

N.W.—Mickle and Great Shunnor Fells. Masham.

N.E.—Seamer. Scarborough Mere.

We have already shown that *M. vexator* Cooke must be regarded as identical with *M. strictissimum* Rabenh. (cfr. Journ. Roy. Micr. Soc., 1897, p. 475). Schmidle (in Hedwigia, 1899, Bd. xxxviii., p. 169) has placed *M. vexator* as a variety of *M. strictissimum*, but we fail to see any distinction between the plants.

100. **Microthamnion kützingianum** Näg.

Not common, but more abundant than the preceding species, and most abundant in the earlier months of the year. A more diminutive plant than the preceding species and much more branched.

S.W.—Cragg Vale, towards Blackstone Edge. Bradford. Frizinghall. Marley, near Bingley.

MID W.—Above Eldwick. Boston Spa. Cocket Moss near Giggleswick. Horton-in-Ribblesdale. Oughtershaw Tarn. Cam Fell. Whernside. Cowgill Wold Moss, Widdale Fell.

N.W.—Mossdale Moor, Widdale Fell. Snaizeholme Fell. Bog, near Widdale Beck.

N.E.—Strensall Common. Carlton Bank.

## Family *CLADOPHORACEÆ.*

### Genus CHÆTOMORPHA Kütz., 1845.

101. **Chætomorpha sutoria** (Berk.) Rabenh.

S.W.—In trough, Heaton, with *Rhizoclonium hieroglyphicum* var. *tortuosum.*

Mid W.—Attached to stones, in stream, near Giggleswick.

### Genus RHIZOCLONIUM Kütz., 1843.

102. **Rhizoclonium hieroglyphicum** Kütz., 1843; em. Stockm., 1890.

S.W.—In canal, Frizinghall.

Mid W.—Shipley Glen. In stream, Giggleswick.

N.W.—Spring on Dodd Fell, 1,500 feet. Duerley Beck near Hawes.

N.E.—Carlton Bank.

Var. **kochianum** (Kütz.), Stockm. [Syn. *Rhizoclonium kochianum* Kütz., 1845; *R. flavicans* Rabenh., 1868 *non* Jurg., 1824; Cooke, Brit. Freshw. Alg., p. 141, t. 54, f. 8?].

N.E.—Cliffs, near Scarborough.

S.E.—Newsholme, near Howden.

Var. **tortuosum** (Kütz.) Stockm.

S.W.—In trough, Heaton, with *Chætomorpha sutoria.*

Mid W.—Shipley Glen. Ingleton.

N.W.—Cautley Spout.

### Genus CLADOPHORA Kütz., 1843.

103. **Cladophora crispata** (Roth.), Kütz.

S.W.—Bradfield (Rev. R. A. Gatty). Halifax. Bradford.

Mid W.—Shipley Glen. Bolton Woods. Dropping Well, Knaresborough. Oughtershaw Moss. Leeds (W. B. Turner).

N.E.—Near Middleton. Near Scarborough.

104. **Cladophora glomerata** (L.) Kütz.

S.W.—Fairly abundant in most streams, rivers, canals, etc. Upper Bradfield (Rev. R. A. Gatty). Castleford. Coxley Valley, Horbury (C. B. Crawshaw and C. P. Hobkirk). Conisborough (H. F. Parsons). Near Keighley. Wibsey.

Mid W.—Moor Allerton, near Leeds (W. B. Turner and J. Abbott). Harrogate. Boston Spa, Wetherby, and Sherburn (F. A. Lees). Shipley Glen! Ilkley and Selby (H. F. Parsons). Kirkby Malham (C. B. Crawshaw and C. P. Hobkirk). Moughton Fell. Attached to stones, Linn Ghyll. Penyghent. Ribblehead. Whernside.

N.W.—Cronkley Fell. Great Shunnor Fell.

N.E.—Strensall. Terrington. Carlton Bank. Scarborough Mere ! (G. Massee). Hayburn Wyke.

105. **Cladophora flavescens** Ag.

S.W.—Rawcliffe Common. Frizinghall Dam. Shipley. Doncaster.

Mid W.—Hawksworth.

S.E.—Hornsea Mere.

106. **Cladophora ægagropila** (L.) Kütz..

S.E.—'In *Walling Fen* Moor, twelve miles west of Hull, a lake of 100 or 200 acres on a large common, subject to be overflowed by salt water from the Humber. This lake has been drained since these vegetable balls were described in Phil. Trans. xlvii., p. 498.'—Camden's Britannia, translated and enlarged from the edition published by the author in MDCVII., by Richard Gough, London, 1789, iii., p. 98.

## Order CONJUGATÆ.

### Family *ZYGNEMACEÆ*.

#### Sub-Family Mesocarpeæ.

##### Genus MOUGEOTIA Ag., 1824.

107. **Mougeotia genuflexa** (Dillw.) Ag., 1824. [Syn. *Conferva genuflexa* Dillw., 1809; *Mougeotia mirabilis* A. Br., 1855; *Mesocarpus pleurocarpus* DeBary, 1858].

S.W.—Rawcliffe, near Selby.

Mid W.—Askham Bog! (T. Hick). Baildon. Holden Ghyll, near Keighley. Penyghent.

N.W.—Mickle Fell. Near 'Moorcock Inn.'

N.E.—Strensall (W. B. Turner). Seamer.

108. **Mougeotia scalaris** Hass., 1842.

[Syn. *Mesocarpus scalaris* Hass., 1845].

S.W.—Dewsbury (C. B. Crawshaw and C. P. Hobkirk). Ogden Clough. Frizinghall. Marley, near Bingley. Near Keighley.

Mid W.—Roundhay (J. Abbott).

N.W.—Cronkley Fell.

N.E.—Strensall! (W. B. Turner).

109. **Mougeotia nummuloides** Hass.

[Syn. *Mesocarpus nummuloides* DeBary].

S.W.—Cullingworth. Keighley Moor.

N.W.—Cronkley Fell. Masham. Near the 'Moorcock Inn.'

N.E.—Strensall (W. B. Turner).

110. **Mougeotia parvula** Hass.

[Syn. *Mesocarpus parvulus* (Hass.) DeBary].

S.W.—Newsholme Dean (T. Hebden). Cullingworth.

Mid W.—Whernside, at 1,900 feet. Askwith (W. B. Turner). Adel Bog. Wigton Moor. Rombald's Moor. Near Ilkley. Black Hill, near Settle.

N.W.—Mickle and Cronkley Fells. Masham.

N.E.—Scarborough Mere. Strensall! (W. B. Turner).

Var **angusta** (Hass.) Kirchn.

[Syn. *Mesocarpus angustus* Hass.].

Mid W.—Adel Bog. Baildon. Above Eldwick. Penyghent.

N.W.—Mickle Fell. Sedbergh.

111. **Mougeotia recurva** (Hass.) De Toni.

[Syn. *Mesocarpus recurvus* Hass.].

Mid W.—Baildon.

N.E.—Strensall.

112. **Mougeotia depressa** (Hass.) Wittr.

[Syn. *Mesocarpus depressus* Hass.].

N.W.—Mickle and Cronkley Fells. River Ure.

N.E.—Scarborough Mere.

113. **Mougeotia gracillima** (Hass.) Wittr.

[Syn. *Staurospermum gracillimum* (Hass.) DeBary].

Mid W.—Rombald's Moor. Blubberhouses (W. B. Turner). Ingleborough. Penyghent. Ribblehead. Cowgill Wold Moss, Widdale Fell.

N.W.—Mickle and Cronkley Fells. Cotterdale.

N.E.—Strensall. Seamer.

114. **Mougeotia viridis** (Kütz.) Wittr.

[Syn. *Staurospermum viride* Kütz.].

S.W.—Near Rotherham. Cullingworth! (T. Hebden).

Mid W.—Bog, two miles south of Clapham. Austwick. Horsforth (J. Abbott).

S.E.—Loftsome Bridge, near Wressle.

115. **Mougeotia quadrangulata** Hass. [Syn. *M. quadrata* (Hass.) Wittr.; *Staurospermum quadratum* (Hass.) De Bary].

N.E.—Strensall. Pilmoor, near Thirsk.

116. **Mougeotia capucina** (Bory) Ag.

N.E.—Pilmoor, near Thirsk, very fine (vi., 98).

### Sub-Family Zygnemeæ.

### Genus DEBARYA Wittr.

117. **Debarya calospora** (Palla) Nob. [Syn. *Mougeotiopsis calospora* Palla in Ber. der Deutsch. Botan. Gesellsch., Jahrg. 12, 1894, heft 8, pp. 228-236, t. xviii.].

N.E.—Pilmoor, near Thirsk.

We showed this interesting plant to be a true species of *Debarya* in Ann. of Bot., March, 1898, vol. 12, p. 49; it certainly possesses pyrenoids, which, as in *D. lævis* (Kütz.) West and G. S. West, are somewhat variable in size and disposition.

The zygospores are less elliptical than those figured by Palla. Thickness, fil. 13 $\mu$; zygospores 18–20 $\mu$ × 22–26 $\mu$.

Not previously recorded for the British Isles.

GENUS ZYGNEMA Ag., 1817; em. DeBary, 1858.

118. **Zygnema ordinarium** Berk., 1832. [Syn. *Zygogonium parvulum* Kütz., 1849; *Zygnema parvulum* (Kütz.) Cooke, 1882].

N.W.—Cronkley Fell.

N.E.—Strensall.

119. **Zygnema Ralfsii** (Hass.) De Bary.

[Syn. *Zygogonium Ralfsii* (Hass.) Kütz.].

MID W.—Bramhope and Adel (J. Abbott).

N.E.—Strensall (W. B. Turner).

120. **Zygnema pectinatum** (Vauch.) Ag.

S.W.—Near Heckmondwike (C. B. Crawshaw and C. P. Hobkirk).

N.W.—Great Shunnor Fell. Lund's Fell.

121. **Zygnema cruciatum** (Vauch.) Ag.

S.W.—Wibsey. Cullingworth.

MID W.—Bramhope (J. Abbott). Baildon. Ingleborough.

N.W.—Cronkley Fell. Sedbergh.

122.—**Zygnema stellinum** (Vauch.) Ag.

S.W.—Thornton Moor.

MID W.—Eldwick. Cam Fell.

N.W.—Mickle and Cronkley Fells. Cotterdale.

N.E.—Strensall ! (W. B. Turner).

123. **Zygnema Vaucherii** Ag.

N.E.—Pilmoor, near Thirsk.

Var. **stagnale** (Hass.) Kirchn.

MID W.—Baildon.

N.W.—Mickle Fell.

N.E.—Strensall (W. B. Turner).

124. **Zygnema anomalum** (Hass.) Cooke.

[Syn. *Tyndaridea anomala* Hass.].

S.W.—Sharlston (H. F. Parsons).

N.W.—Cronkley and Mickle Fells, frequent.

N.E.—Strensall (W. B. Turner). Pilmoor, near Thirsk.

125. **Zygnema ericetorum** (Kütz.) Hansg. [Syn. *Zygogonium ericetorum* Kütz.; *Z. ericetorum* var. α *terrestris* Cooke and var. β *aquaticum* Cooke; *Z. Agardhii* Rabenh.; *Z. didymum* Rabenh.].

On damp heaths, etc., more or less abundant, forming dark-green patches, which often incline to violet. Also frequent in peaty ditches on upland moors, the filaments often attaining a length of several feet. The aquatic form (forma *fluitans* (Kütz.) Rabenh.) and the terrestrial form (forma *terrestre* Kirchn.) are practically indistinguishable, the former growing equally well on damp peat, although assuming a darker colour.

S.W.—Goole. Thornton. Harden. Keighley Moor.

Mid W.—Bramhope (J. Abbott). Baildon. Rombald's Moor. Simon Seat. Malham (C. B. Crawshaw and C. P. Hobkirk). Giggleswick Common. Bowland Knotts. Ingleborough. Penyghent. Old Cote Moor. Cray Moss.

N.W.—Mickle, Cronkley, and Great Shunnor Fells. Swaledale, up to 2,200 feet. Mossdale Moor, Widdale Fell. Dodd Fell and Lund's Fell, up to 2,000 feet.

N.E.—Strensall ! (W. B. Turner). Pilmoor, near Thirsk. On damp ground, Whitenab, Scarborough.

126. **Zygnema leiospermum** DeBary.

S.E.—Very fine, from Loftsome Bridge, near Wressle.

127. **Zygnema insigne** (Hass.) Kütz.

Mid W.—Malham (vii. 1891).

Genus SPIROGYRA Link, 1820.

128. **Spirogyra tenuissima** (Hass.) Kütz.

S.W.—Frizinghall. Heaton.

Mid W.—Hawksworth. Baildon. Buckden.

N.W.—River Ure.

N.E.—Strensall (W. B. Turner). Scarborough Mere.

129. **Spirogyra inflata** (Vauch.) Rabenh.

[Syn. *S. tenuissima* forma *inflata* (Vauch.) Cooke].

N.W.—Cronkley Fell.

N.E.—Pilmoor, near Thirsk.

130. **Spirogyra Weberi** Kütz.

S.W.—Hainworth (T. Hebden). Cullingworth. Keighley.

Mid W.—Boston Spa.

N.W.—River Ure.

131. **Spirogyra Grevilleana** (Hass.) Kütz.

S.W.—Dewsbury (C. B. Crawshaw). Keighley.

132. **Spirogyra Hassallii** (Jenner) Petit.

S.E.—Newsholme, near Howden.

133. **Spirogyra insignis** (Hass.) Kütz.

S.W.—Near Mirfield. Near Bradford. Wilsden.

N.W.—Near Sedbergh.

134. **Spirogyra gracilis** (Hass.) Kütz. [Syn. *S. flavescens* (Hass.) Kütz., forma *gracilis* (Hass.) Cooke, and forma *parva* (Hass.) Cooke; *Zygnema gracile* Hass.; *Z. parva* Hass.].

S.W.—In dam at Kexborough (C. B. Crawshaw and C. P. Hobkirk).

Mid W.—Ilkley.

N.W.—Lund's Fell.

Var. **flavescens** (Hass.) Rabenh. [Syn. *S. flavescens* (Hass.) Kütz.; *Zygnema flavescens* Hass.].

S.W.—Soothill, Dewsbury (C. B. Crawshaw). Holmfirth (C. P. Hobkirk). Cullingworth.

Mid W.—Roundhay (W. B. Turner). Baildon. Rombald's Moor. Austwick. Grassington.

N.W.—Cronkley Fell.

N.E.—Strensall. Scarborough Mere.

135. **Spirogyra communis** (Hass.) Kütz. [Syn. *Zygnema commune* Hass.; *Spirogyra longata* (Vauch.) Wittr., 1872].

S.W.—Fixby. Bradford.

Mid W.—Adel Bog (W. B. Turner). Malham.

136. **Spirogyra Jurgensi** Kütz.

MID W.—Baildon Moor.

137. **Spirogyra catæniformis** (Hass.) Kütz.

N.E.—Terrington.

S.E.—Newsholme, near Howden.

138. **Spirogyra varians** (Hass.) Kutz.

MID W.—Baildon Moor (vii. 1895). Ribblehead (iv. 1895).

N.E.—Terrington (vi. 1898). Malton.

S.E.—Newsholme, near Howden.

139. **Spirogyra longata** (Vauch.) Kütz.

[Syn. *Conjugata longata* Vauch.].

S.W.—Thornton Moor. Frizinghall. Near Keighley.

MID W.—Baildon. Adel (J. Abbott). Grassington. Ribblehead.

N.W.—Mickle and Cronkley Fells. Birkdale Tarn Moss.

N.E.—Seamer. Scarborough Mere.

S.E.—Newsholme, near Howden.

140. **Spirogyra pellucida** (Hass.) Kütz.

[Syn. *Zygnema pellucidum* Hass.].

S.W.—Hunslet (J. Abbott).

MID W.—Harrogate (W. B. Turner).

We have not seen this characteristic species from Yorkshire, and should much like to confirm the records by finding further specimens. For a complete account of its characters and peculiarities see G. S. West, 'Alga-Flora of Cambs.,' Journ. of Bot., 1899, p. 109-110.

141. **Spirogyra porticalis** (Vauch.) Cleve [Syn. *S. quinina* (Ag.) Kütz. ; *S. porticalis* var. *quinina* (Ag.) Cooke].

S.W.—Upper Bradfield (Rev. R. A. Gatty). Sharlston (H. F. Parsons). Allerton. Bradford. Frizinghall.

MID W.—Roundhay (J. Abbott). Baildon. Cowside Beck, Arncliffe.

N.E.—Scarborough Mere ! (G. Massee).

142. **Spirogyra condensata** (Vauch.) Kütz.

S.W.—Howley near Dewsbury (C. B. Crawshaw and C. P. Hobkirk). Near Bradford.

Mid W.—Baildon.

N.W.—Great Shunnor Fell. River Ure. Reeth.

N.E.—Scarborough Mere.

143. **Spirogyra velata** Nordst.

Mid W.—In stream, Shipley Glen. A rather smaller form than the type.

144. **Spirogyra nitida** (Dillw.) Link.

S.W.—Howley, near Dewsbury (C. B. Crawshaw and C. P. Hobkirk). Bradford. Wilsden. Marley, near Bingley.

Mid W.—Bramhope and Adel (J. Abbott). Harrogate (T. Hick). Malham.

N.E.—Strensall (W. B. Turner). Scarborough Mere.

145. **Spirogyra crassa** Kütz.

S.W.—Doncaster. Near Heckmondwike (C. B. Crawshaw and C. P. Hobkirk). Manningham.

N.W.—Sedbergh.

N.E.—Scarborough Mere.

Genus CHOASPIS S. F. Gray, 1821.

146. **Choaspis stictica** (Eng. Bot.) O.K., 1891 [Syn. *Conferva stictica* Eng. Bot.; *Choaspis serpentaria* S. F. Gray, 1821; *Sirogonium sticticum* Kütz., 1843].

S.W.—Keighley.

Mid W.—Hawksworth. Baildon. Ingleton.

The habitat given by Rabenhorst (Flor. Europ. Algar., iii., p. 256), is 'in stagnis.' We have never obtained this plant except where the water was running, generally at a spring and attached to stones over which the water was flowing fairly fast.

Gray's description of *Choaspis* (Arrang. Brit. Pl., 1821, vol. 1, p. 299) is a good one of the genus and twenty-two years previous to Kützing's description of *Sirogonium*. His remark 'not slippery' is quite correct, and *Choaspis* is readily distinguished from *Spirogyra*, *Zygnema*, etc., by touch alone.

## Family *DESMIDIACEÆ.*

### Genus GONATOZYGON DeBary, 1856 ; em. 1858.

147. **Gonatozygon Ralfsii** DeBary.

S.W.—Hebden Bridge, abundant in dam (viii. 1895). Cullingworth (with zygospores).

Mid W.—Moor Allerton (W. B. Turner). Wigton Moor. Staveley Dam, near Knaresborough. Cocket Moss, near Giggleswick.

N.W.—Sedbergh, abundant (with zygospores, ix. 1899).

N.E.—Strensall ! (W. B. Turner).

S.E.—Riccall Common.

148. **Gonatozygon Brebissonii** DeBary.

S.W.—Cullingworth.

Mid W.—Adel Bog. Malham Tarn. Cocket Moss, near Giggleswick. Penyghent. Cam Fell.

N.W.—Great Shunnor Fell.

N.E.—Strensall. Pilmoor, near Thirsk.

S.E.—Riccall and Skipwith Commons.

Var. **minutum** Nob. [Syn. *G. minutum* West].

Mid W.—Cocket Moss, near Giggleswick.

S.E.—Riccall Common.

Var. **læve** (Hilse) Nob.

[Syn. *G. læve* Hilse, 1878 ; West, 1889].

Mid W.—Cocket Moss, near Giggleswick. Penyghent.

N.W.—Mickle Fell.

149. **Gonatozygon pilosum** Wolle.

S.E.—Skipwith Common.

150. **Gonatozygon Kinahani** (Arch.) Rabenh.

Mid W.—Malham Tarn, abundant in washings of *Callitriche*, (vii. 1891). Penyghent.

N.E.—Strensall Common.

### Genus SPIROTÆNIA Bréb., 1844.

151. **Spirotænia condensata** Bréb.

S.W.—Ogden Clough (length of cell, 186-192 $\mu$ ; breadth, 26-28 $\mu$). Cullingworth.

Mid W.—Adel Bog (W. B. Turner). Ilkley (W. H. Dikes). Cocket Moss, near Giggleswick.

N.E.—Strensall (W. B. Turner). Pilmoor, near Thirsk. Carlton Bank. Stokesley.

152. **Spirotænia bryophila** (Bréb.) Rabenh.

[Syn. *S. musicola* DeBary].

Mid W.—Shipley Glen (iv. 1895), forming a thin gelatinous stratum amongst mosses on dripping rocks.

153. **Spirotænia minuta** Thur.

N.E.—Pilmoor, near Thirsk, very abundant.

Var. **eboracensis** West & G. S. West.

Mid W.—Cam Fell, not uncommon along with *Cylindrocystis crassa*, *Penium digitus*, *Hyalotheca dissiliens*, etc., in peat bogs.

This variety is relatively shorter in proportion to its breadth than the type; it has also blunter ends and more turns of the spiral. Length, 30-32 $\mu$; breadth, 7-8 $\mu$.

154. **Spirotænia turfosa** West & G. S. West.

Medium-sized; cells sub-cylindrical, elongate, nearly straight, or slightly curved, about twelve times longer than the diameter, gradually attenuated to each pole, apices obtuse; with a single parietal chromatophore, making $1\frac{1}{2}$ to 2 turns and containing a few small pyrenoids. Length, 100-102 $\mu$; breadth, 7·5-8·5 $\mu$; breadth of apices, about 4 $\mu$.

Mid W.—Ilkley, in peaty pools.

This species approaches *S. parvula* Arch., but is of much larger size, is proportionately longer, has more rounded and relatively wider ends, and has more turns of the spiral.

155. **Spirotænia fusiformis** West & G. S. West.

Small, elongate; cells straight or often slightly oblique, ten to twelve times longer than the diameter, cylindrico-fusiform, attenuated towards the apices which are acute but rounded; with a single parietal chromatophore rather irregularly disposed from pole to pole and making about half a turn. Length, 42-58 $\mu$; breadth, 4·3-4·6 $\mu$.

Mid W.—Cowgill Wold Moss, Widdale Fell, in peaty pools amongst *Sphagnum cuspidatum* var. *plumosum*.

The cells were solitary or in pairs (after division), and occurred somewhat sparingly among a large quantity of *Arthrodesmus Incus*. It was very difficult to determine the precise nature of the spiral, because of its irregularity and the small size of the plant; it only made from half to three-quarters of a turn, and the protoplasm (outside the spiral) contained some large granules.

156. **Spirotænia obscura** Ralfs.

N.E.—Terrington, abundant (vi. 1898).

157. **Spirotænia acuta** Hilse.

N.E.—Pilmoor, near Thirsk.

158. **Spirotænia tenerrima** Arch.

N.E.—Pilmoor, near Thirsk.

Genus MESOTÆNIUM Näg., 1849.

159. **Mesotænium DeGreyii** Turn.

Mid W.—Blubberhouses (W. B. Turner). Ilkley. Simon Seat. Black Hill, near Settle.

160. **Mesotænium mirificum** Arch.

S.W.—Ogden Clough, forming gelatinous masses on dripping shale rocks. Length, 25-36 $\mu$; breadth, 15-18 $\mu$.

Mid W.—Ingleton.

161. **Mesotænium macrococcum** (Kütz.). [Syn. *Palmoglæa macrococcum* Kütz., 1845; *Mesotænium Braunii* DeBary, 1858].

S.W.—Hebden Bridge.

Mid W.—Not unfrequent among wet mosses in narrow glens. Adel Bog (W. B. Turner). Above Eldwick. On stones in stream near Giggleswick; also among wet mosses near Giggleswick. Linn Ghyll.

N.W.—Sedbergh.

Var. **micrococcum** (Kütz.) Kirchn. [Syn. *Palmoglæa micrococca* Kütz.; *Mesotænium Braunii* var. *minus* De Bary].

Mid W.—On stones in stream, near Giggleswick.

S.E.—East of Selby.

162. **Mesotænium chlamydosporum** DeBary.

Mid W.—Above Eldwick. Black Hill, near Settle. Cowgill Wold Moss, Widdale Fell.

N.W.—Lund's Fell, at 2,000 feet. Cautley Spout.

Length, 25-32·5 $\mu$; breadth, 12 $\mu$.

163. **Mesotænium caldariorum** (Lagerh.) Hansg.

S.W.—Forming a green gelatinous stratum with *Dactylothece Braunii*, in greenhouse, Bradford (ix. 1896).

The figure given by Turner (in Kongl. Sv. Vet.-Akad. Handl. Bd. 25, no. 5, 1892, t. 1, f. 23) does not at all represent the species. There is an almost imperceptible constriction in the middle of the cell, and the cells are somewhat suddenly attenuated near the apices, which are rounded.

It has not previously been recorded for the British Isles.

164. **Mesotænium Endlicherianum** Näg.

S.W.—Damp shady rocks near Bingley.

Mid W.—Ingleton. Bowland Knotts. Penyghent. Old Cote Moor. Cowgill Wold Moss, Widdale Fell.

N.W.—Lund's Fell.

Length, 25-27 $\mu$; breadth, 8-9 $\mu$.

Var. **grande** Nordst.

S.W.—Cragg Vale, towards Blackstone Edge.

Mid W.—Cocket Moss, near Giggleswick. Black Hill, near Settle.

Length, 52 $\mu$; breadth, 12·5 $\mu$.

165. **Mesotænium purpureum** West & G. S. West.

Cells free-swimming, cylindrical, and slightly curved, $3\frac{1}{2}$ to $4\frac{1}{2}$ times longer than the diameter, poles rounded; chromatophores purple, not interrupted in the middle of the cells.

Length, 32-46 $\mu$; breadth, 9·5-10 $\mu$.

Mid W.—Old Cote Moor, in peat bogs.

GENUS CYLINDROCYSTIS MENEGH., 1838.

166. **Cylindrocystis Brebissonii** Menegh.

[Syn. *Penium Brebissonii* (Menegh.) Ralfs].

A general and widely distributed species, especially on heaths and in moorland districts.

S.W.—Goole Moor (H. F. Parsons). Thornton Moor. Ogden Clough. Denholme. Cullingworth. Near Keighley.

MID W.—Moor Allerton (W. B. Turner). Adel Bog. Bride Cross, above Farnley Moor. Leathley. Near Norwood Hall, above Lindley Reservoir. Ilkley (W. H. Dikes). Boston Spa. Wigton Moor. Earl's Seat. Malham Tarn Bog. Cocket Moss, near Giggleswick. Ingleton. Ingleborough. Black Hill, near Settle. Penyghent. Cray Moss. Oughtershaw Tarn. Cam Fell. Ribblehead (with zygospores in abundance). Whernside, at 2,000 ft.

N.W.—Baugh Fell. Sedbergh. Mickle and Cronkley Fells (with zygospores). Great Shunnor Fell; a pure gathering obtained at over 2,200 ft. Penhill Beacon. Mossdale Moor, Widdale Fell. Bog near Widdale Beck. Lund's Fell, up to 2,000 ft. Dodd Fell, at 2,000 ft. Snaizeholme Fell.

N.E.—Strensall Common (with zygospores). Pilmoor, near Thirsk. Terrington. Carlton Bank. Peat deposit, Filey. Near Scarborough.

S.E.—Riccall Common. Skipwith Common.

167. **Cylindrocystis crassa** DeBary.

S.W.—Ogden Clough. Near Keighley.

MID W.—Adel Bog. Blubberhouses (W. B. Turner). Simon Seat. Ilkley. Cocket Moss, near Giggleswick. Ingleborough. Moughton Fell. Penyghent and Linn Ghyll. Old Cote Moor. Near Buckden. Cam Fell (pure gathering). Whernside, at 2,000 ft.

N.W.—Cautley Spout and Sedbergh. Mickle and Cronkley Fells. Great Shunnor Fell. Lund's Fell. Mossdale Moor, Widdale Fell. Hunter's Hole, Craydale Moor (1,900 ft.).

N.E.—-Strensall.

S.E.—East of Selby.

168. **Cylindrocystis diplospora** Lund.

S.W.—Cullingworth.

Mid W.—Adel Dam. Blubberhouses (W. B. Turner). Ingleborough. Whernside.

N.W.—Mickle Fell. Great Shunnor Fell. Gormire (W. B. Turner). Birkdale Tarn Moss.

N.E.—Pilmoor, near Thirsk. Peat deposit, Filey.

Var. **major** West.

N.E.—Pilmoor, near Thirsk.

S.E.—Riccall Common (forma *constricta* West).

Genus PENIUM Bréb., 1844.

169. **Penium cylindrus** (Ehrenb.) Bréb.

S.W.—Cullingworth.

N.W.—Mickle Fell.

170. **Penium rufescens** Cleve, 1864.

[Syn. *Penium rufopellitum* Roy, 1877].

N.W.—Cronkley Fell.

171. **Penium exiguum** West forma **Lewisii** (Turn.) West & G. S. West.

S.W.—-Keighley Moor.

172. **Penium Digitus** (Ehrenb.) Bréb.

[Inclus. *Penium lamellosum* (Bréb.) Kütz.].

Generally distributed and more or less abundant in upland bogs.

S.W.—Frizinghall. Cullingworth. Ogden Clough. Keighley Moor.

Mid W.—Adel Dam! (W. B. Turner). Eldwick. Rombald's Moor. Ilkley. Malham Tarn Bog. Black Hill, near Settle. Cocket Moss, near Giggleswick. Near Buckden. Cam Fell. Ribblehead. Cowgill Wold Moss, Widdale Fell. Whernside.

N.W.—Baugh Fell. Mickle and Cronkley Fells. Great Shunnor Fell. Mossdale Moor, Widdale Fell. Bog by Widdale Beck. Hunter's Hole, Craydale Moor (1,900 ft.).

N.E.—Strensall!; Gormire (W. B. Turner). Pilmoor, near Thirsk. Terrington. Carlton Bank. Stokesley.

S.E.—Riccall Common.

173. **Penium interruptum** Bréb.

N.W.—Mickle Fell. Great Shunnor Fell.

N.E.—Pilmoor, near Thirsk.

174. **Penium Libellula** (Focke) Nordst., 1888. [Syn. *Closterium Libellula* Focke, 1847; *Penium closterioides* Ralfs, 1848].

S.W.—Cullingworth.

Mid W.—Ilkley (W. H. Dikes). Whernside (iii. 1893).

N.W.—Mickle and Cronkley Fells. Reeth.

N.E.—Seamer.

175. **Penium Navicula** Bréb.

S.W.—Thornton Moor. Keighley Moor.

Mid W.—Baildon Moor. Cocket Moss, near Giggleswick. Bog two miles south of Clapham. Old Cote Moor, and near Buckden.

N.W.—Mickle Fell.

N.E.—Pilmoor, near Thirsk (with zygospores, vii. 1898). Carlton Bank. Stokesley.

S.E.—Riccall Common.

176. **Penium oblongum** DeBary.

S.W.—Greetland, near Halifax. Ogden Clough. Keighley Moor.

Mid W.—Adel (W. B. Turner). Above Eldwick. Ilkley. Ingleborough. Cray Tarn, 2,000 ft. Cam Fell. Ribblehead. Whernside.

N.W.—Mickle Fell. Great Sleddale. Mossdale Moor, Widdale Fell.

N.E.—Carlton Bank.

177. **Penium spinospermum** Joshua.

Mid W.—Cowgill Wold Moss, Widdale Fell (with zygospores). Diam. zygosp. with processes 29-33 $\mu$.

178. **Penium Mooreanum** Arch.

MID W.—Kildwick.

N.W.—Howgill Fells. Mickle Fell (with zygospores).

N.E.—Moorland stream, near Scarborough.

179. **Penium minutissimum** Nordst.

MID W.—Old Cote Moor (viii. 1896).

N.W.—Mickle Fell.

180. **Penium truncatum** Bréb.

S.W.—Thornton Moor, in a tumbling rill in abundance, covering *Scapania undulata*. Cullingworth.

MID W.—Adel Bog. Penyghent.

N.E.—Peat deposit, Filey.

Forma **punctata** West.

S.W.—Greetland, near Halifax,

N.W.—Leeming.

181. **Penium margaritaceum** (Ehrenb.) Bréb.

MID W.—Ilkley (W. H. Dikes). Malham Cove (J. M. Kirk). Cocket Moss, near Giggleswick.

N.W.—Mickle Fell.

N.E.—Pilmoor, near Thirsk.

Var. **punctatum** Ralfs.

S.W.—Cullingworth.

MID W.—Wigton Moor.

182. **Penium spirostriolatum** Barker.

S.W.—Cullingworth.

MID W.—Cocket Moss, near Giggleswick. Oughtershaw Tarn, very abundant (viii. 1896).

N.W.—Hunter's Hole, Craydale Moor, 1,900 ft.

N.E.—Pilmoor, near Thirsk.

183. **Penium polymorphum** Perty.

More or less general in upland, peaty districts.

S.W.—Denholme. Oxenhope. Ogden Clough. Crimsworth Dean.

MID W.—Simon Seat. Malham Tarn Bog. Giggleswick Common. Bowland Knotts. Penyghent. Cray Tarn, 2,000 ft.

Old Cote Moor. Oughtershaw Tarn. Cam Fell. Cowgill Wold Moss, Widdale Fell. Whernside.

N.W.—Baugh Fell. Mickle Fell. Great Sleddale, and up to 2,200 ft. in Swaledale. Birkdale Tarn Moss. Lund's Fell. Mossdale Moor, Widdale Fell. Dodd Fell, 2,000 ft.

N.E.—Strensall.

184. **Penium cucurbitinum** Biss.

Among wet mosses, on dripping rocks, etc.

S.W.—Ogden Clough.

Mid W.—Shipley Glen. Holden Ghyll, near Keighley. Near Ilkley. Penyghent. Cowgill Wold Moss, Widdale Fell.

S.E.—Riccall Common.

Var. **subpolymorphum** Nordst.

N.W.—Mickle Fell. Length 77-82 $\mu$; breadth 35-38 $\mu$.

185. **Penium crassiusculum** DeBary.

Mid W.—Cowgill Wold Moss, Widdale Fell.

186. **Penium curtum** Bréb. [Syn. *Cosmarium curtum* (Bréb.) Ralfs; *Calocylindrus curtus* (Bréb.) Kirchn.].

Mid W.—Near Ilkley! (Miss J. Town). Ingleton. Penyghent.

N.W.—Mickle Fell.

N.E.—Gormire (W. B. Turner).

Forma **major** Wille.

Mid W.—Langcliffe, near Settle. Length 53 $\mu$; breadth 28 $\mu$; breadth of isthmus 26·5 $\mu$.

Var. **obtusum** var. nov.

A large variety with the sides at the base of the semicells subparallel, with broader, subtruncate apices, below which the sides are very faintly hollowed. Length 41-45 $\mu$; breadth 20-23 $\mu$; breadth of constriction 19 $\mu$.

Mid W.—Ingleton, on wet rocks.

187. **Penium cruciferum** (DeBary) Wittr., 1882.

[Syn. *Cosmarium ? cruciferum* DeBary, 1858].

S.W.—Ogden Clough. Keighley Moor.

Mid W.--Above Eldwick. Baildon Moor, in profusion along with *Roya obtusa* var. *montana*, among *Rhacomitrium aciculare*. Plentiful in a ditch near Norwood Hall, above Lindley Reservoir. Appletreewick, in a trough. Cocket Moss, near Giggleswick. Old Cote Moor. Near Buckden. Cray Moss.

S.E.—Market Weighton.

188. **Penium inconspicuum** West.

N.E.—Pilmoor, near Thirsk.

S.E.—Riccall Common, very abundant.

189. **Penium minutum** (Ralfs) Cleve.

[Syn. *Docidium minutum* Ralfs].

Mid W.—Adel Bog (W. B. Turner).

N.W.—Mickle Fell.

N.E.—Gormire (W. B. Turner).

S.E.—Riccall Common.

Genus ROYA West & G. S. West, 1896.

190. **Roya obtusa** (Bréb.) West & G. S. West.

[Syn. *Closterium obtusum* Bréb.].

S.W.—Greetland, near Halifax. Cullingworth.

N.E.—Strensall.

Var. **montana** West & G. S. West.

S.W.—Ogden Clough, in profusion amongst *Mougeotia scalaris*, on dripping rocks.

Mid W.—Baildon Moor, abundant along with *Penium cruciferum*, in washings of *Rhacomitrium aciculare*. Cocket Moss, near Giggleswick. Cam Fell.

191. **Roya Pseudoclosterium** (Roy) West & G. S. West.

[Syn. *Closterium Pseudoclosterium* Roy].

N.E.—Pilmoor, near Thirsk, not uncommon (vii. 1898). Length 98-140 $\mu$; breadth 2·6-3 $\mu$.

This is the first record for this species in England, although it is known from Scotland, N. Wales and W. Ireland.

Genus CLOSTERIUM Nitzsch, 1817.

192. **Closterium Dianæ** Ehrenb.

S.W.—Rawcliffe Common. Askern. Bingley. Cullingworth.

Mid W.—Markington, with zygospores ! (Rev. J. S. Tute). Askwith (W. B. Turner). Baildon. Eldwick. Adel Bog. Rombald's Moor. Farnley. Leathley. Near Norwood Hall, above Lindley Reservoir. Malham Tarn. Moughton Fell. Wigton Moor.

N.W.—Mickle Fell.

N.E.—Gormire ; Strensall ! (W. B. Turner). Pilmoor, near Thirsk. Terrington.

S.E.—Riccall and Skipwith Commons. Hornsea Mere.

A form with a distinctly granulate membrane was observed from Skipwith Common ; the granules were large, but of slight elevation.

193. **Closterium Pseudodianæ** Roy.

Mid W.—Roundhay Park, Leeds (vii. 1898). Cocket Moss, near Giggleswick (iv. 1898).

194. **Closterium parvulum** Näg.

Generally distributed throughout the county.

S.W.—Doncaster. Ogden Clough. Wibsey (with zygospores). Cullingworth. Bingley. Keighley Tarn, and near Keighley (with zygospores).

Mid W.—Adel. Wigton Moor. Eldwick. Baildon Moor. Boston Spa. Cocket Moss, near Giggleswick. Ingleton. Ribblehead. Harrogate. Staveley Dam, near Knaresborough.

N.W.—Mickle Fell. Great Shunnor Fell. Lund's Fell.

N.E.—Strensall. Pilmoor, near Thirsk (with zygospores). Terrington. Near Scarborough. Levisham. Hayburn Wyke.

S.E.—Riccall Common.

Var. **angustum** var. nov.

Smaller than the typical form and considerably narrower.

Diam. 7·7 $\mu$ ; apices 94-102 $\mu$ apart.

N.E.—Pilmoor, near Thirsk.

195. **Closterium arcuatum** Bréb.

S.E.—Skipwith Common.

196. **Closterium Jenneri** Ralfs.

S.W.—Wakefield (W. H. Dikes). Cullingworth.

Mid W.—Adel Bog. Ilkley. Malham Tarn Bog. Cocket Moss, near Giggleswick.

N.W.—Mickle Fell.

N.E.—Pilmoor, near Thirsk. Terrington.

S.E.—Riccall Common.

Var. **robustum** G. S. West.

N.E.—Pilmoor, near Thirsk.

197. **Closterium incurvum** Bréb.

N.E.—Pilmoor, near Thirsk (vii. 1898). Breadth 11 $\mu$; apices 52 $\mu$ apart.

198. **Closterium Venus** Kütz.

S.W.—Rawcliffe Common. Frizinghall. Cullingworth.

Mid W.—Alwoodley (W. B. Turner). Eldwick. Wigton Moor. Cocket Moss, near Giggleswick.

N.W.—Mickle Fell.

N.E.—Strensall. Pilmoor, near Thirsk. Scarborough Mere.

S.E.—Riccall and Skipwith Commons.

199. **Closterium eboracense** Turner.

[Syn. *C. Cucumis* Wolle non Ehrenb.].

S.W.—Campsall, Doncaster (W. B. Turner).

Mid W.—Chapel-Allerton (W. B. Turner).

N.W.—Mickle Fell [recorded as *C. Cucumis*].

200. **Closterium Leibleinii** Kütz.

S.W.—Rawcliffe Common. Askern. Near Mirfield. Fixby. Frizinghall. Keighley.

Mid W.—Baildon. Wigton Moor. Boston Spa. Arthington. Adel. Ilkley. Bolton Woods. Harrogate. Ribblehead.

N.W.—Mickle Fell.

N.E.—Strensall ! (W. B. Turner). Scarborough Mere. River Derwent, Forge Valley. Saltburn.

S.E.—Market Weighton. Hornsea Mere. Beverley. Newsholme. Routh.

201. **Closterium moniliferum** (Bory) Ehrenb.

An abundant and widely-distributed species.

S.W.—Goole (W. G. Tacey). Hatfield Chase (J. M. Kirk). Drax (H. F. Parsons). Askern. Morley. Denholme. Hebden Bridge. Heaton.

Mid W.—Adel Bog (W. B. Turner). Baildon. Rombald's Moor. Ilkley. Farnley. Bolton Woods. Harrogate (J. M. Kirk). Staveley Dam, near Knaresborough. Holden Ghyll, near Keighley. Near Settle. Malham Tarn. Cocket Moss, near Giggleswick. Moughton Fell. Penyghent. Buckden. Ingleton.

N.W.—Sedbergh and Cautley Spout. Mickle and Cronkley Fells.

N.E.—Thirkleby Park (W. B. Turner). Staindale. Pilmoor, near Thirsk. Terrington. Hayburn Wyke.

S.E.—Newsholme, near Howden.

202. **Closterium Ehrenberghii** Menegh.

General, but not abundant.

S.W.—Askern. Markington ! (Rev. J. S. Tute). Wakefield (W. H. Dikes). Denholme. Wibsey. Manningham. Armley (J. Abbott). Keighley.

Mid W.—Hawksworth near Shipley (H. F. Parsons). Adel ! (J. Abbott). Baildon. Eldwick. Rombald's Moor. Near Boston Spa. Cocket Moss, near Giggleswick. Bowland Knotts. Horton-in-Ribblesdale. Moughton Fell.

N.W.—Great Shunnor Fell.

N.E.—Gormire (W. B. Turner). Strensall. Pilmoor, near Thirsk. Malton. Near Scarborough.

S.E.—Newsholme, near Howden.

203. **Closterium Malinvernianum** DeNot., 1865.

[Syn. ? *C. Cordanum* Gutw., 1896].

Mid W.—Adel Bog (W. B. Turner). Boston Spa. Cam Fell.

N.E.—Pilmoor, near Thirsk.

204. **Closterium decorum** Bréb.

Mid W.—Boston Spa.

205. **Closterium Cynthia** DeNot.

N.E.—Pilmoor, near Thirsk. Carlton Bank.

206. **Closterium acerosum** (Schrank) Ehrenb.

S.W.—Rawcliffe Common. Hatfield Chase (J. M. Kirk). Wibsey. Frizinghall. Cullingworth. Saltaire. Farnley. Keighley, with zygospores.

Mid W.—Markington, with zygospores! (Rev. J. S. Tute). Baildon. Eldwick. Ben Rhydding. Ingleborough. Horton-in-Ribblesdale. Penyghent.

N.W.—Great Shunnor Fell.

N.E.—Gormire (W. B. Turner). Seamer. Scarborough Mere. River Derwent, Forge Valley.

S.E.—Skipwith Common. Brackenholme. Newsholme, near Howden. Beverley.

Var. **truncatum** Gutw.

S.W.—Rawcliffe Common. Nab Wood, near Bingley.

207. **Closterium lanceolatum** Kütz.

S.W.—Heaton. Allerton. Frizinghall. Cullingworth. Near Keighley.

Mid W.—Roundhay. Adel Bog (W. B. Turner). Otley. Bolton Woods. Moughton Fell. Penyghent.

N.W.—Cronkley Fell.

N.E.—Hayburn Wyke. Gormire (W. B. Turner). Carlton Bank. Near Scarborough.

S.E.—Hornsea Mere. Waghen.

208. **Closterium Lunula** (Müller) Nitzsch.

Mid W.—Somewhat rare. Markington! (Rev. J. S. Tute). Ilkley. Harrogate! (J. M. Kirk). Cocket Moss, near Giggleswick. Bog two miles south of Clapham.

S.W.—Denholme. Crimsworth Dean. Esholt. Allerton (large forms; diam. 108 $\mu$).

N.W.—Mickle and Cronkley Fells.

N.E.—Strensall! (W. B. Turner). Pilmoor, near Thirsk. Scarborough Mere.

S.E.—Kirkham Abbey (J. M. Kirk).

Var. **intermedium** Gutw.

Mid W.—Bog two miles south of Clapham.

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